

MODULE V - GROUNDWATER MONITORING

V.A. POST-CLOSURE GROUNDWATER MONITORING

V.A.1. The Permittee shall monitor groundwater in the impacted aquifer as described below, and in a manner that will monitor the release of hazardous constituents from the Industrial Waste Lagoon, in compliance with R315-8-6 during the compliance period as defined in Condition V.C.4.

V.A.2. Certain solid waste management units (SWMUs) may be subject to certain provisions of this Module. The Executive Secretary shall determine which SWMUs may be subject to some or all of the provisions of this Module. The Permittee shall comply with the provisions of R315-8-6.12.

V.A.3. The Permittee shall follow all of the provisions listed under R316-8-6, Groundwater Protection, and as defined by the conditions of this permit. The present compliance point wells are listed in Condition V.A.4.

V.A.3.a. The Area of Compliance is defined as all monitoring wells located within the impacted aquifer and displaying concentrations above those specified in Module V, Table V-2.

V.A.4. The Permittee shall maintain a groundwater monitoring system. The monitoring well system consists of all A, B, C, D, N, P, and T- series wells dedicated to monitoring the release of hazardous constituents from the Industrial Waste Lagoon and Industrial Area contaminant sources, except those that have been abandoned in accordance with the Technical Enforcement Guidance Document (TEGD), OSWER-9950.1, September 1986, and subsequent addenda. Thirty days prior to a sampling event, the Permittee shall submit to the Executive Secretary for approval a list of monitoring wells proposed for sampling and a map highlighting the well locations. The list will include the rationale for the proposed well selections. The monitoring well system, piezometers, and the compliance point monitoring well locations are presented in Attachment 1.

V.A.5. The Permittee shall monitor groundwater as it enters and exits the treatment system. The purpose of this monitoring is to ensure that the groundwater treatment system is removing the volatile organic hazardous constituents specified in Condition V.B.1.a (Table V-1) of this module to a level below the concentration limit listed in Table V-2.

V.A.6. The Permittee shall monitor and record the rate and volume of the flow of groundwater as it is pumped from the extraction wells, as it enters and exits the groundwater treatment system, and as it is pumped into the injection wells. The purpose of this monitoring is to ensure the proper operation of the groundwater treatment system and to ensure the continuous flow of groundwater through the groundwater treatment system.

V.A.7. If for any reason the groundwater treatment system is unable to operate for a period of 90 days or longer and if during this period of non-operation, the groundwater treatment system contains untreated groundwater, the Permittee must provide for the removal and disposal of the groundwater from the system as specified in Conditions VI.E.3.a.

V.A.8 The Permittee shall monitor and record the concentration of Trichloroethylene (TCE) and the other constituents listed in Condition V.B.1.a. in the impacted aquifer, and shall submit maps to show the concentration of TCE in this aquifer as specified in Condition V.F.1.

V.B. REQUIRED PROGRAM

V.B.1. The Permittee shall conduct a monitoring and response program as follows for the Industrial Waste Lagoon subject to these provisions:

V.B.1.a. The Permittee has completed a groundwater quality assessment. This assessment indicated that the following hazardous constituents listed in Table V-1 below, were released from the Industrial Waste Lagoon, entered the impacted aquifer, and have been detected beyond the compliance point and beyond the north boundary of the Tooele Army Depot, Tooele, Utah. The Permittee must provide for the monitoring of volatile compounds as specified in the CDQMP (Volume II, Attachment 2).

TABLE V-1

Benzene	Carbon Tetrachloride
Chloroethane	Chloroform
1,1-Dichloroethene	1,1-Dichloroethane
1,2-Dichloropropane	1,2-Dichloroethene
Ethylbenzene	Methylene Chloride
Tetrachloroethene	1,1,1 -Trichloroethane
Trichloroethylene	Toluene
Xylene	1,2-Dichloroethane

V.B.1.b. Because the groundwater protection standard under R315-8-6 and Condition V.C. of this permit has been exceeded, the Permittee has undertaken a groundwater quality assessment program, and implemented a corrective action program as defined under R315-8-6.11, and Module VI. The purpose of this corrective action program is to remove the hazardous waste constituents above from the groundwater.

V.B.1.c. The Permittee shall monitor the groundwater for the purpose of evaluating the presence of 1,4-dioxane. Monitoring will focus on groundwater contamination originating near building 619 and 609 located on the former Tooele Army Depot Industrial Area. Monitoring will be conducted annually for a period of four years, or until such time that the Executive Secretary determines that 1,4-dioxane is or is not a chemical requiring

further study. Samples from monitoring wells located down gradient of the former Industrial Waste Lagoon will be collected and analyzed only once, unless there are detections of 1,4-dioxane, in which case samples will be collected during all four annual events. Monitoring wells to be sampled, as well as the duration of sampling are:

Well Location	Duration
C-19	4 Annual Events
C-21	4 Annual Events
C-35	4 Annual Events
C-37	4 Annual Events
C-17	4 Annual Events
A-2A	4 Annual Events
B-26	4 Annual Events
C-9	4 Annual Events
B-7	1 Annual Event if Non-Detect/4 Annual Events if Detected
B-35	1 Annual Event if Non-Detect/4 Annual Events if Detected

V.B.1.d. The Permittee may apply for an Alternate Concentration Limit (ACL). This petition may be submitted if,

V.B.1.d.i. The corrective action described in Modules V and VI fails to meet the groundwater protection standard defined in Condition V.C., and after the Permittee has demonstrated that all other feasible methods have been used to meet the groundwater protection standard, or

V.B.1.d.ii. If, in accordance with R315-101, a risk assessment concludes that a contaminant concentration greater than the concentration limits specified in Condition V.C., Table V-2, poses no unacceptable risk to human health or the environment.

V.B.1.e. If submitted, the Executive Secretary shall determine, within 180 days, the appropriateness of any ACL petition, and either accept, or reject, the proposed concentration level. If the Executive Secretary determines that the level is appropriate, the Permittee shall initiate a modification to the permit in accordance with Condition I.D.3.

V.B.1.f. Upon termination of any instituted corrective action program under R315-8-6.11., the Permittee shall initiate and maintain a detection monitoring program under R315-8-6.9. and Condition V.E. of this permit.

V.C. GROUNDWATER PROTECTION STANDARD

V.C.1. The Permittee shall monitor the groundwater, as specified in Condition V.A. to determine whether the corrective action program outlined in Module VI of this permit is effective in removing hazardous waste constituents from the groundwater and to determine compliance with the groundwater protection standard under R315-8-6.3.

V.C.2. The groundwater protection standard was established by a Petition for Approval of Cleanup Levels. This petition was approved by the Utah Solid and Hazardous Waste Control Board. The hazardous waste constituents listed in V.C.3. below, and their approved concentration limits comprise the groundwater protection standard. If alternate concentration limits are approved per Condition V.B.1.c., the Permittee shall initiate a permit modification in accordance with Condition I.D.3. of this permit to incorporate the approved alternate concentrations limits into the Groundwater Protection Standard.

V.C.3. Required SW-846 test methods and detection limits are listed below. If an alternate test method is to be proposed for use, the Permittee shall request a permit modification as specified in Condition I.F.13.c. If, at any time during the duration of this permit, the Executive Secretary determines that the test methods specified in Table V-2 are not sensitive enough to produce the required results, the Executive Secretary shall require the Permittee to use alternate test methods (e.g. EPA Method SW846 500 or 600 series test methods). If the Executive Secretary requires a change to the test method(s), the Permittee shall modify the permit.

TABLE V-2

HAZARDOUS WASTE CONSTITUENT ug/l	TEST METHOD	CONCENTRATION LIMIT ug/l	PQL
Benzene	8260	5.0	1.0
Carbon Tetrachloride	8260	5.0	1.0
Chloroethane	8260	1.3	1.0
Chloroform	8260	100.0	1.0
1,1-Dichloroethane	8260	170.0	1.0
1,2-Dichloroethane	8260	5.0	1.0
1,1-Dichloroethene	8260	7.0	1.0
1,2-Dichloroethene	8260	1.0	1.0
1,2-Dichloropropane	8260	5.0	1.0
Ethylbenzene	8260	700.0	1.0
Methylene Chloride	8260	5.0	1.0
Tetrachloroethene	8260	5.0	1.0
1,1,1-Trichloroethane	8260	200.0	1.0
Trichloroethene	8260	5.0	1.0
Toluene	8260	1000.0	1.0
Xylenes	8260	10000.0	1.0

V.C.4. As indicated by R315-8-7, the post-closure care period for the Industrial Waste Lagoon is 30 years from January 7, 1991. If any of the groundwater protection standards in Condition V.C. above are still exceeded after 30 years, the Permittee shall continue corrective action as specified in Condition VI.G.

V.D. GROUNDWATER MONITORING REQUIREMENTS

V.D.1 General Requirements: The Permittee shall comply with the following general requirements for groundwater monitoring:

V.D.1.a. The groundwater monitoring system shall consist of the wells specified in Attachment 1. A permit modification to account for new wells, after installation has been completed (including slug-testing), will be submitted on an annual basis, prior to April 15, as specified in Table V-4, updating Attachment 1.

V.D.1.b. All monitoring wells shall be constructed in accordance with the provisions in R315-8-6.8(c) and Condition V.D.2.

V.D.1.c. The groundwater monitoring program shall include sampling and analysis procedures defined in R315-8-6.8(d) and (e). The CDQMP is provided as Attachment 2 to this permit.

V.D.1.d. The Permittee shall follow the requirements for measurement of the groundwater surface elevation of R315-8-6.8(f).

V.D.1.e. The Permittee shall sample groundwater as it enters and exits the groundwater treatment system. At a minimum, each quarter there shall be one sample collected from combined system inflow, one sample collected from combined system outflow, and one sample collected from every active extraction well, to represent the influent water and the effluent water. Each sampling point, as specified in Condition V.E.6., shall be protected from contamination between sampling events. The Permittee shall collect influent water and effluent water samples consistent with the sample and analysis procedures defined in R315-8-6.8(d) and (e) and consistent with the CDQMP found in Attachment 2. Reporting requirements are specified in Table V-5.

V.D.1.f. The Permittee shall measure and record the rate and volume of the flow of groundwater through the groundwater treatment system.

V.D.1.g. If the Executive Secretary receives information indicating that the surveyed well casing elevations of the wells in the groundwater treatment system as specified in Condition VI.C.1.a. exceed 0.01 inch from a fixed datum, or the groundwater monitoring system as specified in Conditions V.A.4., are inadequate, the Executive Secretary shall require the Permittee to resurvey any or all of these well casing elevations.

V.D.1.h. The Permittee shall notify the Executive Secretary as required by Conditions I.L. and V.A.4. in writing at least 30 days prior to any sampling event required under this permit. The Permittee shall provide a listing of monitoring wells proposed for sampling, a map highlighting their location and the rationale for their selection shall be made as part of this notification.

V.D.1.i. The Permittee may add or remove existing wells or install new wells as part of the monitoring well system only upon modification approval of the Executive Secretary.

V.D.1.j. The Permittee must at all times maintain a monitoring well system as specified in Condition V.D.1.a. The monitoring wells and the piezometers listed in Condition V.A.4., may not be removed without modification approval of the Executive Secretary.

V.D.1.k. The Executive Secretary may, upon notification to the Permittee, require any of the A, B, C, D, N, P, and T- series wells presently installed, to be added to the semi-annual monitoring well system sampling event, in response to the Permittee's proposed well listing as stated in Conditions V.A.4 and V.D.1.h.

V.D.1.l. The Permittee shall provide for the proper disposal of contaminated groundwater generated during groundwater monitoring well sampling and during the development of new monitoring wells. The Permittee shall dispose of the water as specified in Condition VI.E.3.

V.D.2. Well Location Installation and Construction

The Permittee shall locate, install, construct, and maintain new groundwater monitoring wells as specified below;

V.D.2.a. Well construction shall follow the techniques described in the Technical Enforcement Guidance Document (TEGD), OSWER-9950.1, September 1986 and subsequent addenda and Master Workplan for Solid Waste Management Unit 58. All monitoring wells shall be cased in a manner that maintains the integrity of the monitoring well bore hole. This casing shall be screened or perforated, and packed with gravel or sand where necessary, to enable collection of groundwater samples. The annular space, the space between the bore hole and well casing above the sampling depth must be sealed with bentonite grout to prevent contamination of samples and the groundwater.

V.D.2.b. The Permittee shall construct and maintain new monitoring wells and piezometers in accordance with plans and specifications to be submitted to the Executive Secretary for approval. The Executive Secretary will approve in writing the following: number, location, depth, and design of all new wells and piezometers prior to installation. Installation of new monitoring wells and piezometers shall constitute a permit modification. The Permittee shall follow the procedures specified in Condition I.D.2. for permit modifications.

V.D.2.c. Additional groundwater monitoring wells shall be installed to maintain compliance with Condition V.A.3.a.if subsurface conditions significantly change after permit issuance. Such changes may include, but are not limited to, water level elevation or apparent flow direction changes, or detection of one of the hazardous constituents in a monitoring well. If hazardous waste constituents exceeding the groundwater protection standard concentration limits, as defined in Condition V.C. of this Module, are detected in the furthest most hydraulically downgradient monitoring well(s), the Executive Secretary may require the Permittee to install additional groundwater monitoring wells further downgradient.

V.D.2.d. Upon notification by the Executive Secretary in writing or as a result of a compliance action, the Permittee may be required to install and sample additional wells at any time during the post-closure or compliance periods if new information or unforeseen circumstances reveal a need for additional monitoring to protect human health and the environment.

V.D.2.e. The Permittee shall submit monitoring well completion reports within 90 days after completion of the wells installed after permit issuance. These reports shall include boring logs, sieve analysis (grain size), standard penetration tests, analytical tests performed on soils (Atterberg limits, etc.), water level elevations, groundwater contour maps, well development results including recharge rates, cross sections or fence diagrams, pump tests or slug test, as well as all other data.

V.D.2.f. Existing monitoring wells shall be maintained in a fully operational condition for the duration of this permit. The Permittee shall notify the Executive Secretary within seven (7) days when a well is no longer properly functioning (including the presence of sandy or silty materials, and cracked or broken casings). The Executive Secretary shall approve the conditions for replacement or correction of improperly operating well(s). Replacement of an existing well that has been damaged or rendered inoperable, without change to location, design, or depth of the well shall constitute a change to a permit condition and shall require a permit modification.

V.D.2.g. The Permittee shall determine once every 12 months the depth to the bottom of all groundwater monitoring wells, and report the findings by April 15 of every year. A total depth survey for all extraction and injection wells is due once every three years or sooner, depending on the conditions of the pumps. If a problem is observed, the Permittee shall follow the procedures described above in Condition V.D.2.f. regarding notification and corrective procedures.

V.D.2.h. The Executive Secretary shall approve the permanent removal of any wells listed in Attachment 1, or any wells installed after permit issuance. A request for the removal or installation of wells shall constitute a request for a permit modification.

V.D.2.i. The Permittee shall permanently remove wells from the monitoring well system in accordance with conditions specified in Condition V.D.2.h. above. Well plugging and abandonment methods shall be submitted to the Executive Secretary 30 days prior to the date the wells are removed from the monitoring program.

V.D.3. Sampling and Analysis Procedures

V.D.3.a. The Permittee must include and maintain consistent sampling and analysis procedures in the groundwater monitoring program that are designed to ensure reliable monitoring results of groundwater quality below the Industrial Waste Lagoon. As required by R315-8-6.8(d), the program shall include procedures and techniques for:

V.D.3.a.i. sample collection;

V.D.3.a.ii. sample preservation and shipment;

V.D.3.a.iii. analytical procedures;

V.D.3.a.iv. chain-of-custody control; and

V.D.3.a.v. quality assurance and quality control.

V.D.3.b. The sampling and analytical methods must be appropriate for groundwater sampling and accurately measure hazardous waste constituents in groundwater samples, as required by R315-8-6.8(e).

V.D.3.c. The Permittee shall use the following techniques and procedures when obtaining samples and analyzing samples from the groundwater monitoring wells and for obtaining and analyzing influent and effluent samples from the groundwater treatment units:

V.D.3.c.i. Samples from monitoring wells and influent and effluent samples from each groundwater treatment unit shall be collected by the techniques described in the CDQMP.

V.D.3.c.ii. All samples shall be preserved and transported in accordance with the procedures specified in the CDQMP.

V.D.3.c.iii. Any change to the sampling or analysis procedures specified in the CDQMP, Attachment 2, Module V, and Module VI, shall constitute a request for a Class 1 permit modification.

V.D.3.c.iv. All samples shall be analyzed according to test methods delineated in Module V Section C or an equivalent EPA-approved method that has been pre-approved, by the Executive Secretary as per Permit Condition I.F.13.a. In addition:

V.D.3.c.iv.A. All major peaks greater than 25% of the peak height of the closest internal standard will be identified using the most current NBS Library. The quantity of these compounds will be estimated and reported based upon the closest internal standard.

V.D.3.c.iv.B. Any major peak found during the analysis may become a target parameter.

V.D.3.c.iv.C. All data will be collected and validated as outlined in the CDQMP. The Permittee shall resample all wells from which data is rejected.

V.D.3.c.iv.D. The Executive Secretary may request at any time all laboratory QA/QC documentation and supporting data on any sampling episode. The raw organics information for required sampling and analysis, including organics gas chromatographic printouts, mass spectral analyses, and QA/QC surrogate and spiking results shall be

retained by the U.S. Army Corps of Engineers, and made available at Tooele Army Depot within 72 hours of request, throughout the post-closure care period.

V.D.3.c.iv.E. All samples shall be tracked and controlled using the chain-of-custody procedures specified in the CDQMP.

V.D.3.c.iv.F. In case of loss of sample integrity (i.e. breakage, loss), resampling shall take place within seven days of the loss of sample integrity.

V.D.4. Groundwater Elevations

V.D.4.a. The Permittee shall determine the groundwater surface elevation in the wells and piezometers listed in Attachment 1 semi-annually, as listed in Table V-4. If the Executive Secretary receives information indicating the need for additional measurement of groundwater surface elevations, the Executive Secretary will notify the Permittee that the permit must be modified to change the frequency of monitoring of groundwater surface elevations. This change shall constitute a permit modification.

V.D.4.b. The Permittee shall determine the groundwater surface elevation in all extraction and injection wells specified in Condition VI.C.1.a. The Permittee shall, on a semi-annual basis, construct maps of the potentiometric surface in impacted aquifer. If, based on semi-annual monitoring as specified in Condition V.D.4.a. above, the Executive Secretary determines the need for additional information, the Permittee shall be required to install additional piezometers and monitoring wells. In this case, the Executive Secretary will notify the Permittee in writing that the permit must be modified as specified in Condition V.D.2.b.

V.D.4.c. The Permittee shall determine the groundwater flow rate and direction in the impacted aquifer based on groundwater surface elevation measurements and on resurveyed well apron elevations as required by V.D.1.g. An updated potentiometric map shall be submitted to the Executive Secretary with each semi-annual report as specified by Condition V.F.3, and as listed in Table V-4.

V.E. MONITORING PROGRAM AND DATA EVALUATION

The Permittee shall determine groundwater quality as follows:

V.E.1. The Permittee shall collect, preserve, and analyze groundwater samples pursuant to Permit Condition V.D.

V.E.2. The Permittee shall determine the groundwater flow rate and direction in the impacted aquifer at least every 12 months. This information shall be included in the semi-annual report specified by Condition V.F.1., Table V-3, and reported as listed in Table V-4.

V.E.3. The Permittee shall sample on a semi-annual basis, and report as listed in Table V-4, the monitoring system wells agreed to by the Executive Secretary, in accordance with the provisions of V.A.4. These samples shall be analyzed for the presence of the hazardous constituents listed in Condition V.C.3. (Table V-2).

V.E.4. The Permittee shall sample the groundwater at each point that it enters and exits the groundwater treatment system. These samples shall be collected on a quarterly basis, as listed in Table V-4. These samples shall be collected according to the procedures specified in the CDQMP.

V.E.5. The Permittee shall analyze samples collected from the monitoring wells, and shall analyze groundwater samples that enter and exit the groundwater treatment system using the test methods and concentration levels listed in Condition V.C.3., Table V-2. Based on changes in technology or site conditions, the Permittee may petition the Executive Secretary to modify these parameters.

V.E.6. The Permittee shall monitor and record the rate and volume of the flow of groundwater as it is pumped from the extraction wells, as it enters and exits the groundwater treatment units, and as it is pumped into the injection wells. This monitoring shall occur weekly. A table summarizing the data collected during the weekly monitoring shall be submitted as a part of each of the semi-annual reports specified in Conditions V.F.2., Table V-4.

V.F. REPORTING AND RECORDKEEPING

V.F.1. The Permittee shall submit semi-annual reports on the effectiveness of the corrective action program. These reports shall be submitted no later than April 15 and October 15 of each year. The semi-annual reports shall contain the information and be submitted at the frequency as specified in Table V-3 below:

TABLE V-3

TYPE OF INFORMATION	FREQUENCY
Weekly measurements of volume and rate of groundwater flow in the groundwater treatment system.	weekly
Results of sample analysis including; concentration of hazardous constituents, and a summary of the QA/QC data listed in Condition V.D.3.	semi-annual
Measurements of static water levels and total well depths.	semi-annual
Results of annual model recalibration and a summary analysis of annual model results.	annual
Potentiometric maps of the impacted aquifer. This map shall indicate the rate and direction of groundwater flow.	semi-annual
Contaminant concentration maps of the impacted aquifer.	annual
Tables and graphs (time series) of chemical concentrations of sampled wells, if detected at or above concentration limits.	semi-annual
Identification of potential “hot spots” meriting attention for further evaluation.	semi-annual <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> Subsequent report will identify trends if any anomalies persist and propose corrective action or modification to the system </div>

V.F.2. The Permittee shall submit to the Executive Secretary the analytical results required by Permit Conditions V.D., V.E., and the groundwater elevation data required by Condition V.D.4. in accordance with the following schedule:

TABLE V-4

Samples and data collected during the months of	Semi-annual sampling events	Results due to the Executive Secretary
January-June	Jan-June	October 15
July-Dec	July-Dec.	April 15

Annual groundwater model updates, contaminant concentration maps, as well as new monitoring well completion reports shall be submitted by October 15 of every year.

V.F.3. Quarterly reporting. Groundwater system influent and effluent samples, as well as groundwater samples from all active extraction wells shall be reported quarterly (by January 15, April 15, July 15, and October 15 of every year).

V.G. ASSURANCE OF COMPLIANCE

The Permittee shall assure that monitoring and corrective action measures necessary to achieve compliance with the groundwater protection standard are taken during the term of the permit.